Supplementary Information

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| Supplementary Table S1. Baseline soil nutrient levels in 2018 for the corn and soybean fields amended with rye hay and sawdust in Freeville, NY | |
| Soil nutrient |  |
| Organic matter (%) | 2.74 |
| pH | 6.27 |
| P (mg·Kg-1) | 20.4 |
| K (mg·Kg-1) | 100.8 |
| Al (mg·Kg-1) | 24.6 |
| Ca (mg·Kg-1) | 1053 |
| Fe (mg·Kg-1) | 2.0 |
| Mg (mg·Kg-1) | 63.1 |
| Mn (mg·Kg-1) | 14.9 |
| Zn (mg·Kg-1) | 19.6 |

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| Supplementary Table S2. Average number of weed seeds spread on each corn and soybean plot and the percent each species comprised of the total weed species community biomass in Freeville, NY | | | | |
| Weed | Weight (g) | Average seeds (number) | Weed biomass in 2020  (% of total) | Weed biomass in 2021  (% of total) |
| *Abutilon theophrasti* | 2.5 | 240 | 2.63 | 0.37 |
| *Amaranthus powellii* | 0.4 | 912 | 22.30 | 3.27 |
| *Ipomoea hederacea* | 2.5 | 107 | 1.35 | 0 |
| *Trifolium repens* | 1.5 | 1129 | 0.35 | 0 |

Supplementary Figure S1. Accumulated rainfall at the Freeville research farm in 2020 (orange line), 2021 (blue line), and average over 10 years from 2010-2019 (black line). Shaded area is the standard error of the mean.